Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

Target 9.5: Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

Indicator 9.5.2: Researchers (in full-time equivalent) per million inhabitants

Institutional information

Organization(s):

United Nations Educational, Scientific and Cultural Organization (UNESCO)

Concepts and definitions

Definition:

The researchers (in full-time equivalent) per million inhabitants is a direct measure of the number of research and development workers per 1 million people.

Concepts:

The OECD Frascati Manual (OECD, 2015) provides the relevant definitions for research and experimental development, gross domestic expenditure on R&D and researchers. Although an OECD manual, the application is global. During the 6th revision of the Frascati Manual, developing country issues were mainstreamed in the core of the Manual. The 7th edition was released in October 2015.

The following definitions, taken from the 2015 edition of the Frascati Manual are relevant for computing the indicator.

Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge.

Researchers are professionals engaged in the conception or creation of new knowledge. They conduct research and improve or develop concepts, theories, models, techniques instrumentation, software or operational methods.

The Full-time equivalent (FTE) of R&D personnel is defined as the ratio of working hours actually spent on R&D during a specific reference period (usually a calendar year) divided by the total number of hours conventionally worked in the same period by an individual or by a group.

Rationale:

The indicator is a direct measure of the number of research and development workers per 1 million people referred to in the target.

Comments and limitations:

R&D data need to be collected through surveys, which are expensive, and are not done on a regular basis in many developing countries. Furthermore, (developing) countries do not always cover all sectors of performance. In particular the business sector is not always covered.

Methodology

Computation method:

Computation of the indicator Researchers (in full-time equivalent) per million inhabitants uses available population data as denominator.

Treatment of missing values:

- ***At country level:***

Missing data are not estimated by the UIS.

- ***At regional and global levels:***

Imputations are based on interpolations or extrapolations of data for other reference years. Second option is to make an estimate for FTE based on available headcount data. In case no data are available at all, the unweighted regional average is used as an estimate.

Regional aggregates:

Missing data are imputed using the methodology described above. The data for researchers in FTE are then added up by region and divided by the population data for that region. Similar for the global total.

Sources of discrepancies:

There are no differences in the underlying data. Difference may occur due to the use of difference data for the denominator used to calculate indicators.

Methods and guidance available to countries for the compilation of the data at the national level:

Countries are responsible themselves for the collection of R&D data at the national level, compile national totals and submit them to international organisations. All countries follow the guidelines of the OECD Frascati Manual: http://www.oecd-ilibrary.org/science-and-technology/frascati-manual-2015_9789264239012-en.

Countries starting to measure R&D can use UIS Technical Paper 11 for assistance, which can be downloaded here: uis.unesco.org/sites/default/files/documents/guide-to-conducting-an-rd-survey-for-

countries-starting-to-measure-research-and-experimental-development-2014-en.pdf.

Quality assurance:

The UNESCO Institute of Statistics (UIS) sends out a questionnaire every year to collect R&D data from all countries (around 125 countries), which are not covered by the data collections of the other partner organizations such as the Organisation for Economic Co-operation and Development (OECD), Eurostat (Statistical Office of the European Union) and the Network on Science and Technology Indicators – Ibero-American and Inter-American (RICYT). In agreement with these three organisations, their data (which were collected from their member states/associated member states – around 65 countries-) are directly obtained from the respective databases (in the case of the OECD and Eurostat) or received from the partner (in the case of RICYT). There is also collaboration in Africa with the African STI Indicators Initiative (ASTII) of AU/NEPAD. For the data UIS sends a questionnaire to, the quality assurance process is the following:

- A questionnaire is sent to focal points in countries, generally within the Ministry of Science and Technology or the national statistical office.
- UIS processes the questionnaires, communicating with the countries in case of questions, calculates indicators and releases the data and indicators on its website.
- Countries are requested to complete the questionnaire using the standard international classifications, therefore adjustments are generally not needed. The other agencies have similar procedures.

After processing the data, but before submitting the data for inclusion in the SDG database, UIS sends the calculated indicators for target 9.5 to all countries that do not submit their data to Eurostat or the OECD. This provides the countries with the opportunity to review the data and provide any modifications or additions before UIS submits the data to UNSD.

Data sources

Description:

Data are collected through national R&D surveys, either by the national statistical office or a line ministry (such as the Ministry for Science and Technology).

Collection process:

The UIS sends out a questionnaire every year to collect R&D data from all countries (around 125 countries), which are not covered by the data collections of the other partner organizations such as the Organisation for Economic Co-operation and Development (OECD), Eurostat (Statistical Office of the European Union) and the Network on Science and Technology Indicators – Ibero-American and Inter-American (RICYT). In agreement with these three organisations, their data (which were collected from their member states/associated member states – around 65 countries-) are directly obtained from the respective databases (in the case of the OECD and Eurostat) or received from the partner (in the case of RICYT). There is also collaboration in Africa with the African STI Indicators Initiative (ASTII) of AU/NEPAD, which may lead to a joint data collection in the future.

For the data UIS sends a questionnaire to, the process is the following:

- A questionnaire is sent to focal points in countries, generally within the Ministry of Science and Technology or the national statistical office.

- UIS processes the questionnaires, communicating with the countries in case of questions, calculates indicators and releases the data and indicators on its website.
- Countries are requested to complete the questionnaire using the standard international classifications, therefore adjustments are generally not needed.

Data availability

Description:

Data available for over 120 countries for Researchers (in FTE) per million inhabitants

Time series:

Data available in the UIS database since reference year 1996, but historical data available back to 1981

Disaggregation:

Researchers can be broken down by sector of employment, field of science, sex and age.

Calendar

Data collection:

UIS sends out the questionnaire in September every year. The OECD and Eurostat collect data twice per year.

Data release:

July every year

Data providers

Name:

National R&D surveys, either by the national statistical office or a line ministry (such as the Ministry for Science and Technology).

Description:

Data are collected through national R&D surveys, either by the national statistical office or a line ministry (such as the Ministry for Science and Technology).

Data compilers

The UIS, Organisation for Economic Co-operation and Development (OECD), Eurostat (Statistical Office of the European Union) and the Network on Science and Technology Indicators – Ibero-American and Inter-American (RICYT), African STI Indicators Initiative (ASTII) of AU/NEPAD

References

URL:

www.uis.unesco.org

References:

OECD (2015), Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris. DOI:

http://dx.doi.org/10.1787/9789264239012-en.

UIS Data centre:

http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS&popupcustomise=true&lang=en.

Related indicators as of February 2020

9.b, 12.a, 17.6, 17.7, 17.8